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Geology - Mineralogy

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Series A

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE NIXON FORK MINING DISTRICT, MEDFRA QUADRANGLE, CENTRAL ALASKA, 1949*

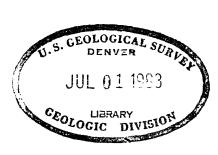
Ву

Max G. White and John M. Stevens

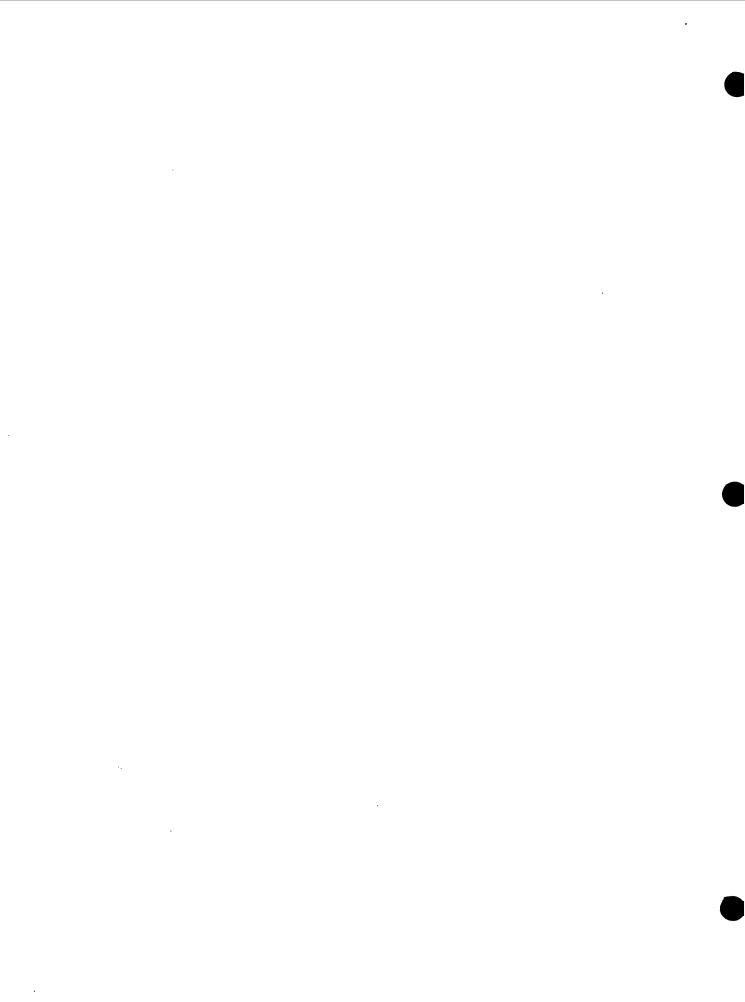
February 1953

Trace Elements Investigations Report 75

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^{*}This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission



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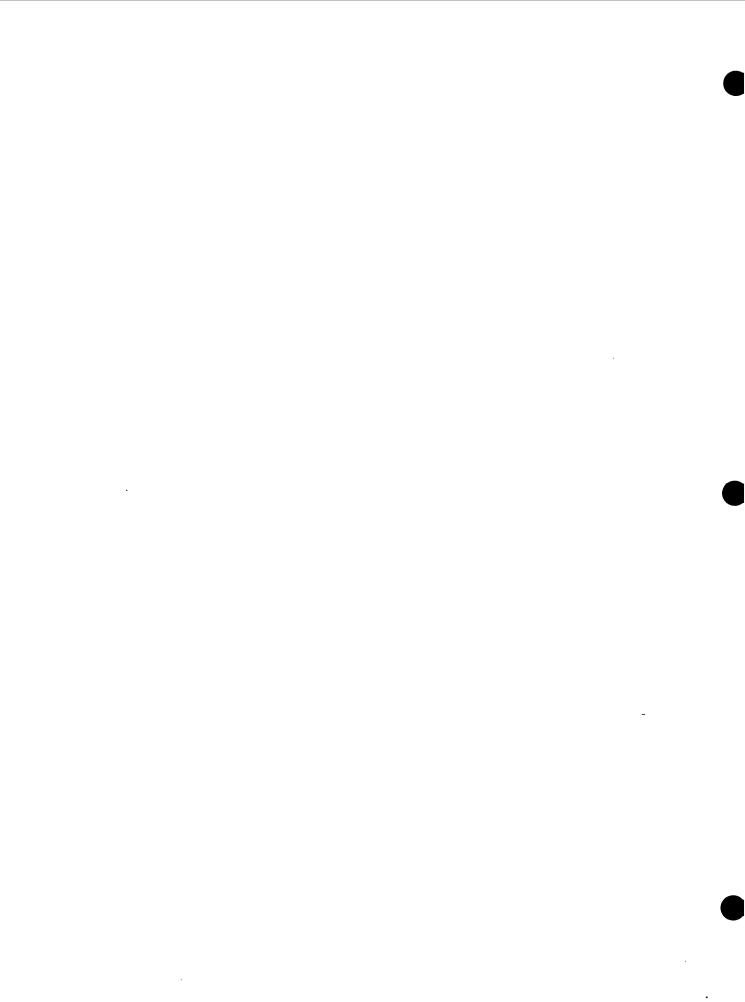
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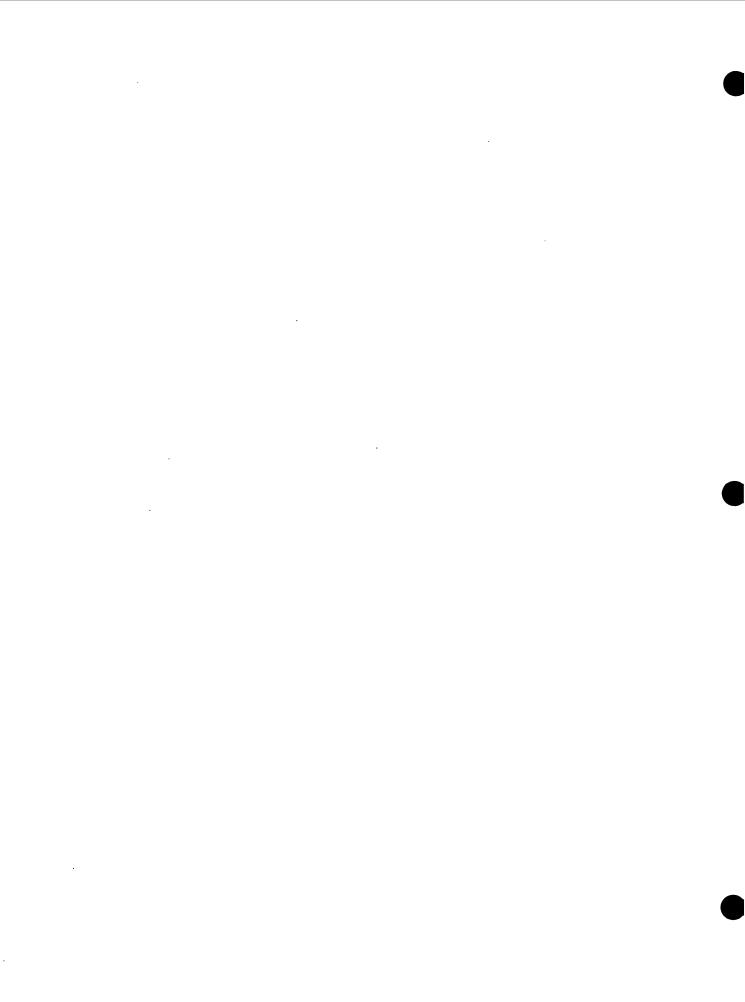
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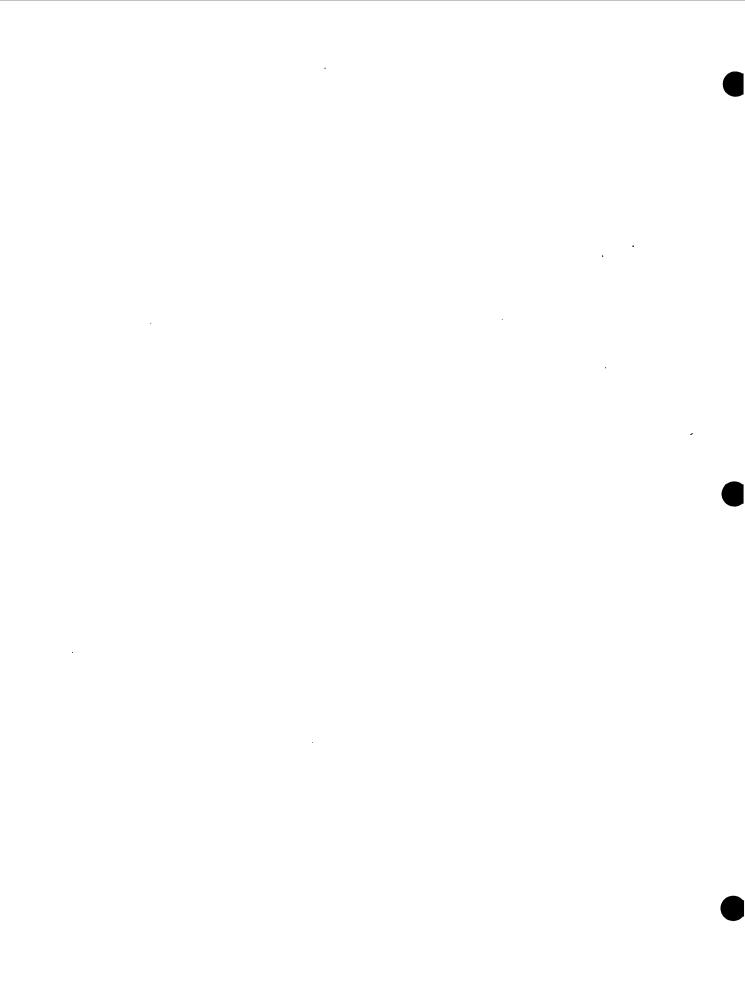


MINING DISTRICT, MEDFRA QUADRANGLE, CENTRAL ALASKA, 1949

By Max G. White and John M. Stevens

ABSTRACT

Reconnaissance for radioactive deposits in the Nixon Fork mining district, Medfra quadrangle, central Alaska, in 1949 disclosed the occurrence of allanite in samples containing as much as 0.05 percent equivalent uranium from the dump of the Whalen mine; the presence of radioactive parisite (a rare-earth fluocarbonate) in a highly altered limestone containing about 0.025 percent equivalent uranium near the Whalen shaft; and radioactive idocrase in samples of altered garnet rock with about 0.025 percent equivalent uranium, from the Crystal shaft of the Nixon Fork mine. This radioactivity is due mostly to thorium rather than uranium. Placer concentrates from Ruby and Eagle Creeks contain 0.078 and 0.26 percent equivalent uranium respectively, in which the radioactivity is due chiefly to uraniferous thorianite. The bedrock source of the uraniferous thorianite was not located primarily because much of the area is overlain by a relatively thick mantle of vegetation (mostly moss) which limited the effectiveness of radiometric surveying. The uraniferous thorianite is believed to occur in a restricted zone or zones at or near the contact of limestone with monzonite similar to the gold-copper ores of the district and the deposits of radioactive parisite and garnet rock at the Whelan and Crystal shafts respectively.



INTRODUCTION

The Nixon Fork mining district (fig. 1) is in a low range of hills of the Kuskokwim Mountains, about 12 miles north of Medfra, a small settlement on the Kuskokwim River 95 miles upstream from McGrath, in central Alaska. Access to the area is by boat or airplane from McGrath to Medfra, and from Medfra to the mines by truck.

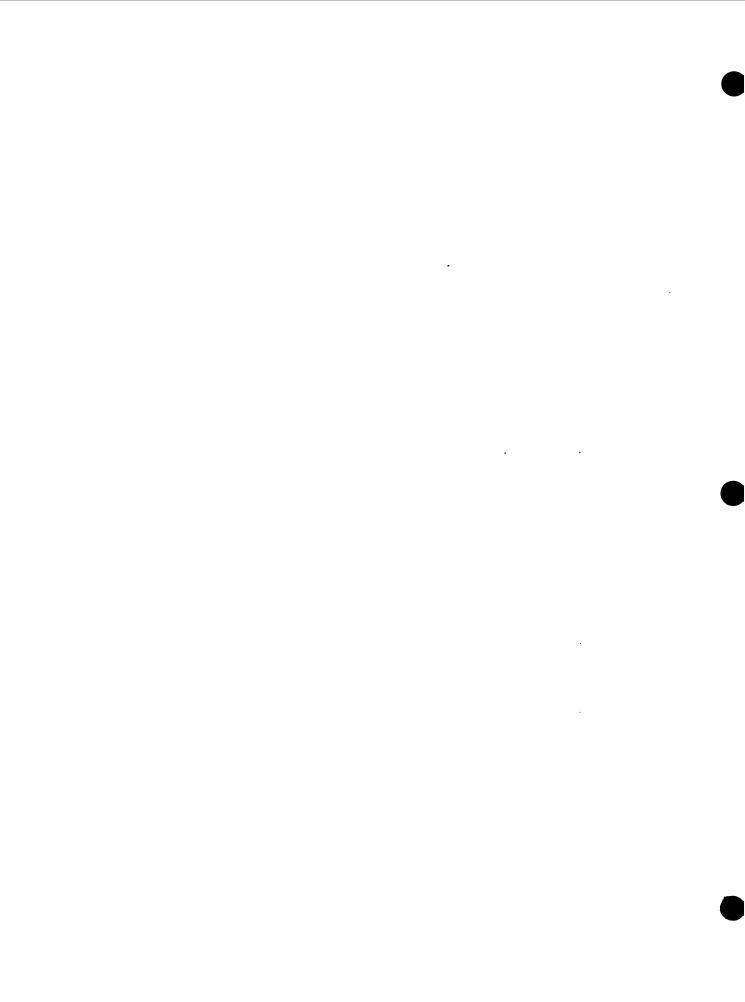
The term "Nixon Fork mines" has long been used for both lode and placer mines in the district. Most of the lode-mining property is held by the Nixon Fork Mining Co., whose principal owners are the Mespelt brothers of McGrath. Their property is called the Nixon Fork mine. The only other lode-mining property of any importance is the Whalen mine, adjacent to and south of the Nixon Fork mine property.

Some of the radioactive placer concentrates from the Nixon Fork mining district available in the Geological Survey's Alaskan Geology Branch placer concentrate file before 1949 (table 1) contain uraniferous thorianite associated with bismuth and copper minerals. This association suggested that the district was favorable for the occurrence of a uranium-bearing lode deposit. Therefore, in 1949, a Geological Survey party conducted a reconnaissance in the district to determine its uranium possibilities. Approximately three weeks were required for the investigation, of which one and a half days were spent at a gold-lode prospect on Eagle Creek, about 5 to 7 miles south of the main Nixon Fork mines (fig. 1). The party consisted of M. G. White and J. M. Stevens, geologists, and Egil Salveson and R. D. Olson, camp assistants. This work was done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.



Table 1.--Data on concentrates collected in the Nixon Fork mining district before 1949.

7.1eld no.	Location and description	uranium
7 ::	Nixon Fork mine; mill concentrates	20,07
; `	Hidden Creek, above Drv Gulch: placer concentrate	031
ميآس		980°
Li.	Greer Gulch; placer concentrate	.003
-	Holmes Gulch; placer concentrate	800.*
name in		
_	Whistling Gulch; placer concentrate	900.
_	Nixon Fork mine; mill concentrates	<!--</td-->
-	Ruby Creek; placer concentrate	.012
	Birch Gulch; placer concentrate	* 000
	Hidden Creek, between Whistling and Dry Gulches; placer concentrate	.013
_	Whistling Gulch; placer concentrate	900*.
	Puzzle Creek; placer concentrate	.002
-	Holmes Gulch; placer concentrate	
ш	Encio Gulch; placer concentrate	.005
-	Hidden Creek, below Encio Gulch; placer concentrate	.012
~	Mystery Creek; placer concentrate	40°
α	Ruby_Creek; placer concentrate	005
بظما	Ruby Creek; placer concentrate	∠ 00 √
_	Hidden Creek, above Encio Gulch; placer concentrate	010°
	Nixon Fork mine; concentrate from mill tailings	°,002
	Dry Gulch; placer concentrate	.00
	Submarine Creek: placer concentrate	,002



GEOLOGY, MINERAL DEPOSITS, AND RADIOACTIVITY INVESTIGATIONS

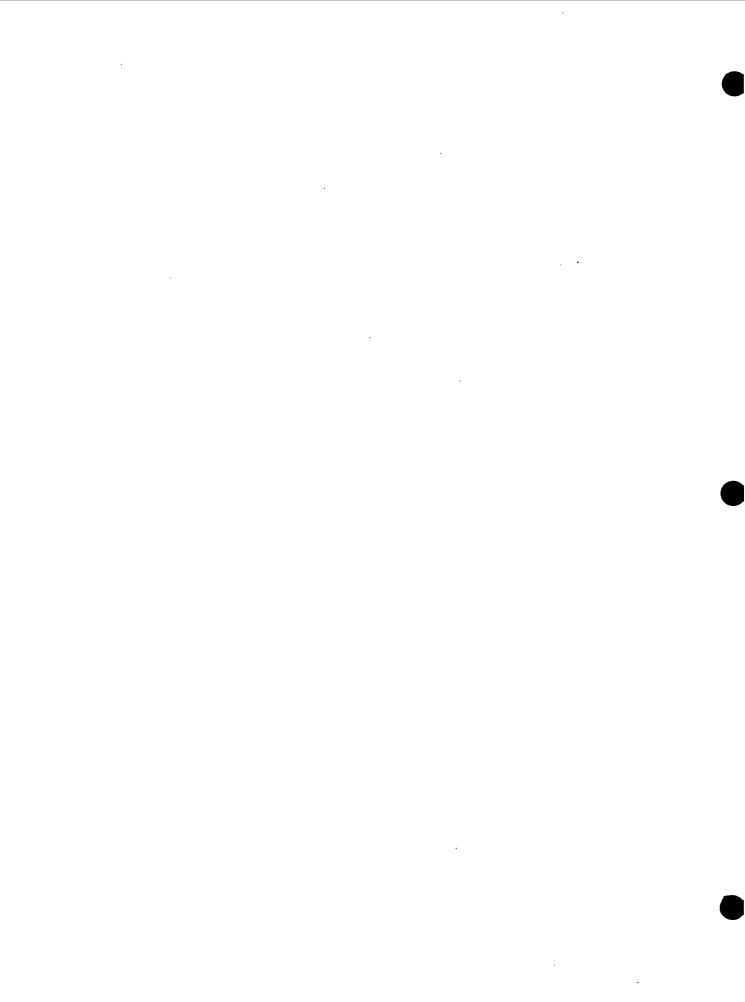
The low range of hills on which the Nixon Fork mines are located is composed of Paleozoic limestone and Upper Cretaceous sandstone, shale, and slate. The rocks are intruded by quartz monzonite that is probably Eocene in age. The lode deposits in the district are an enrichment in limestone along contact metamorphic zones between the limestone and monzonite. Most of the mineral deposits are apparently restricted to the valleys of the tributaries of Hidden Creek and the slopes around the north headwater fork of Ruby Creek (fig. 1). No mineral deposits of any note have been found along the eastern edge of the monzonite.

Placer gold was found on Ruby Creek in the winter of 1917, and shortly thereafter, the lode deposits at the head of Crystal Gulch were located. In 1920 a 10-stamp mill was installed at the head of Ruby Creek to process the highly oxidized copper-gold ores from the various shafts and prospects in the district. Mining and milling has been carried on in the district intermittantly since 1920.

More detailed descriptions of the geology, mineral deposits, and mining of the Nixon Fork district are contained in reports by Martin (1922), Brown (1926), and Mertie (1936).

As is the case with much of interior Alaska, the area around the Nixon Fork mines is thickly covered with underbrush of willow, alder, spruce and birch, and by mass, which averages about 3 feet in thickness. These conditions make the results of radiometric traversing at best inconclusive, except in the localities where recent mining developments have uncovered sufficient bedrock for direct examination.

The mineral deposits on the properties of the Nixon Fork Mining Co. and at the Whalen mine contain both copper and gold, and occur along the contact between



the limestone and monzonite. The highly mineralized part of the contact zone is exposed by a large number of shafts and prospect pits, and, hence, was examined in some detail. Much of the remainder of the contact could not be examined because of the moss cover.

Hidden Creek area

Some of the samples in the Nixon Fork district with the greatest concentration of thorianite come from Encio Gulch, a tributary of Hidden Creek (fig. 1). However, radiometric traverses around the head of Hidden Creek and its headwater tributaries gave negative results. The results are negative, not so much because of the lack of any radioactive materials, which may be perfectly possible, but probably because the valley is covered almost completely by a thick shielding cover of moss and low brush. Concentrates from stream gravels collected during the 1949 investigations are listed in table 2. They are somewhat lower in radioactivity than the pre-1949 samples because the latter were obtained when placer operations were active in the valley. The occurrence of bismuth in the placers is apparently restricted to the valley of Hidden Creek above Dry Gulch, and, because it is thought that all of that portion of the valley of Hidden Creek is underlain by monzonite, it is likely that the bismuth is restricted to the monzonite.

Whalen mine

The main shaft of the Whalen mine is located at the head of Homes Gulch very near the contact between the limestone and monzonite. The limestone forms an island surrounded by monzonite (fig. 1). At this shaft boulders of limestone on the waste

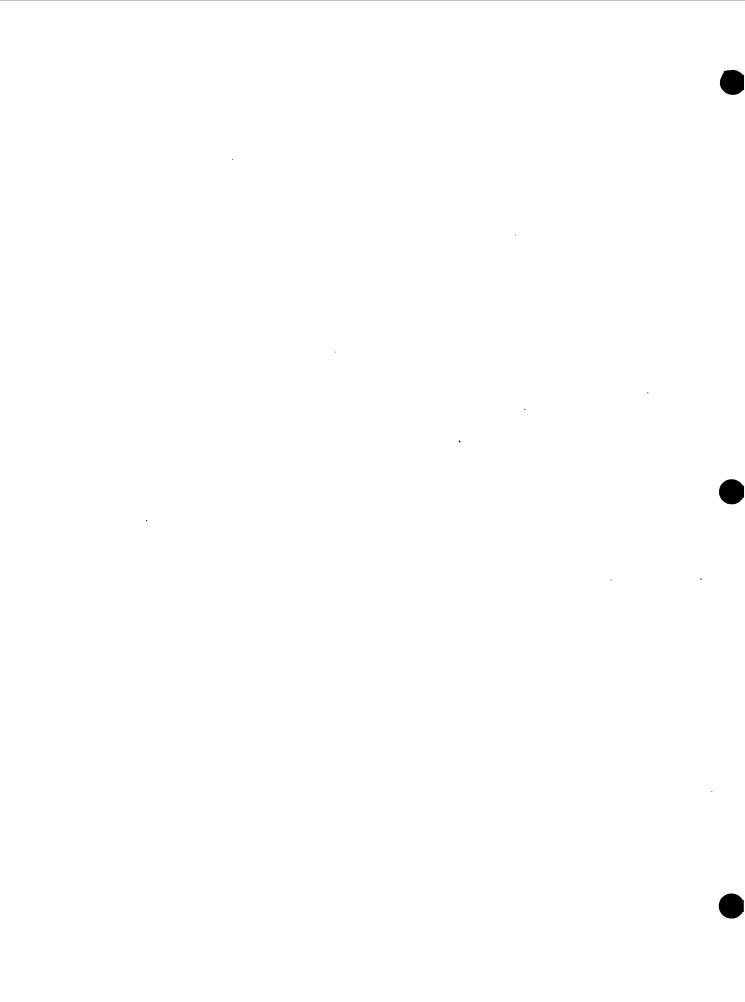
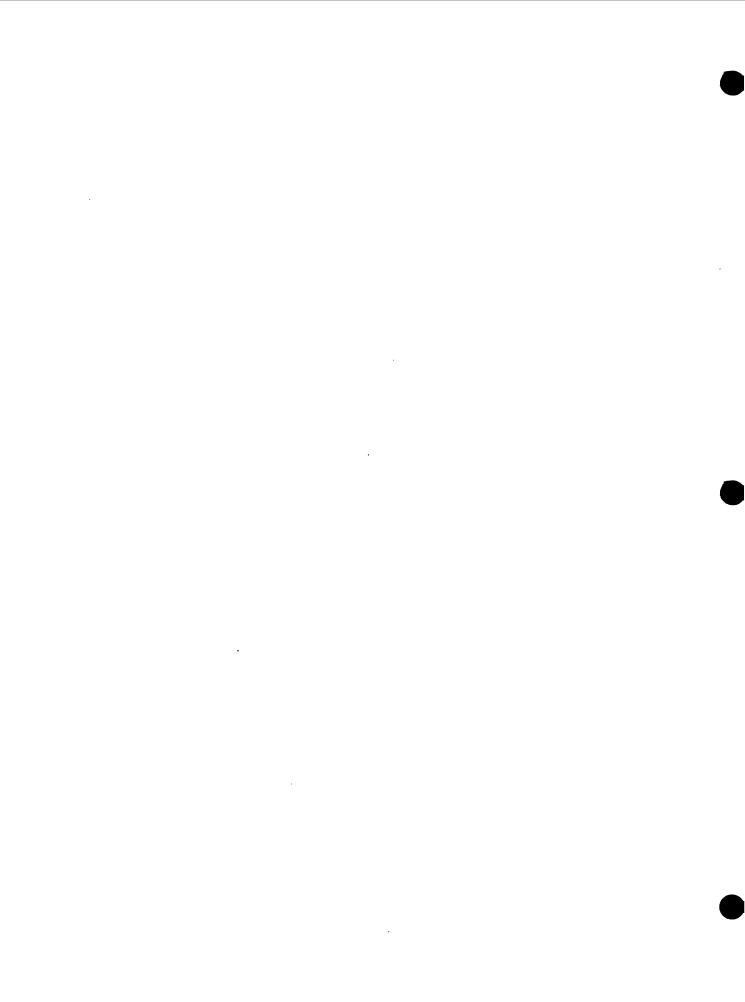


Table 2.--Data on placer concentrates collected from Hidden Creek and its tributaries in 1949.

File no. Field	Field no.	Location	Concentration	Percent equivalent uranium in heavy-mineral fraction
3574 49ASv 108	80	Hidden Cr èc k, above Encio Gulch	145:1	0.009
	109	Hidden Creek, left limit tributary above Encio Gulch	400:1	900.
3576	110	Hidden Creek, extreme head, 1,000 feet below road	120:1	900.
3577	111	20	310:1	200.
m	112	Hidden Creek, prospect hole	275:1	900.
•	113	Birch Gulch, 1,000 feet above mouth	360:1	.012
3580	114	Dry Gulch, 1,500 feet above mouth	630:1	.003
	115	Hidden Creek, 1/2 mile above Birch Gulch	150:1	.005
	116	Hidden Creek, 1/2 mile above Birch Gulch;		500.
		tailings pile		
3583	117	Whistling Gulch, near mouth	190:1	200.
	118	Holmes Gulch, left headwaters fork	270:1	.005
	119	Encio Gulch, left headwaters fork	60:1	, 00 ,
3585	120		90:1	*002
3586	121	Encio Gulch, near mouth	80:1	900.



dump are radioactive and contain a high percentage of a black mineral. The equivalent uranium content of the boulders is 0.05 percent, but fluorometric analysis indicates a uranium content of only 0.004 percent (table 3). It is assumed, therefore, that most of the radioactivity of these rocks is due to thorium. The heavy-mineral concentrate (that greater than 2.8 specific gravity) of the rock consists of 98 percent allanite (the radioactive mineral) and 2 percent zircon, kyanite and scheelite. These heavy minerals constitute about 25 percent of the rock.

A short distance east of the main shaft is a large depression about 40 feet deep formed as the result of a cave-in on the 40-foot level of the mine. Most of the material of the cave-in was high-grade gold ore and was mined out, leaving a "glory hole".

Along the walls of the glory hole is exposed highly weathered metamorphic rock consisting mainly of quartz and limestone that has an average content of about 0.025 percent equivalent uranium (table 3). However, chemical analyses show only 0.002 percent uranium in this rock. The radioactive mineral is parisite (a rare-earth fluocarbonate) that makes up about 95 percent of the heavy-mineral fraction of the rock.

The main shaft of the Whalen mine is 200 feet deep and is inclined at an 85 degree angle down the contact. This shaft could not be examined because it was filled with ice to within 12 feet of the top.

There are between 150 and 200 small shafts and prospect pits along the contact between the limestone and monzonite in the vicinity of the Whalen mine. Approximately 80 of the prospect pits were cleaned out and tested radiometrically in an effort to discover any additional concentrations of radioactive minerals. A few of the holes tested have a higher than normal radioactivity and were sampled for further study (table 3). Radiometric analyses of these samples indicate an equivalent uranium content ranging from 0.001 to 0.006 percent (table 3). The radioactive

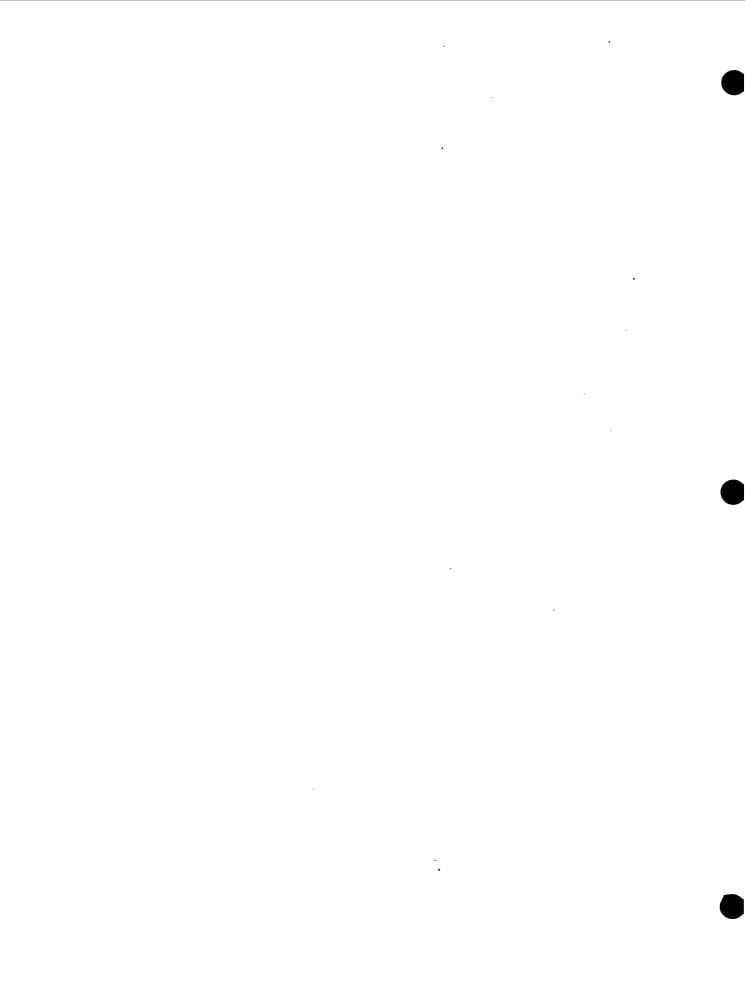


Table 3.--Data on samples collected from the Whalen mine and vicinity

જા											
Heavy-mineral fraction 3/ eU Concentration rcent) ratio		4:1	4:1	900:1	850:1	35:1	160:1	400:1	30:1	2,400:1	640;1
Heavy- eU (percent)		0.081	80.	90.	14	41.	1.	01.	. 12	.019	2.
Crushed rock eU 1/ U 2/ (percent) (percent)		0.004	1	1	ŀ	.002	ł	.002	.002	1	.002
Crushe eU 1/ (percent)	nine	0.05	ŀ	ŀ	ł	.03	i	.02	.03	!	.005
Location and description	Samples collected at Whalen mine	Whalen mine	Same as sample 3619; concentrate from	Whalen mine "glory hole"; wash from	"Glory hole"; rock along contact between highly weathered limestone and highly	leached limestone, panned concentrate Same as sample 3622; highly weathered	Same as 3623; panned concentrate	Same as 3622; weathered limestone	-	rypes or samples 3023 and 3023 Slope east of Whalen mine shaft; decom-	posed limestone; panned concentrate Same as sample 3627; unconcentrated rock
Samples 10. Field no.		49AWe 127	128	129	130	132	133	134	135	150	151
Sarr File no.		3619	3620	3621	3622	3623	3624	3625	3626	3627	3628

^{1/} eU - equivalent uranium $\overline{2}/$ U - uranium $\overline{3}/$ that greater than 2.8 specific gravity

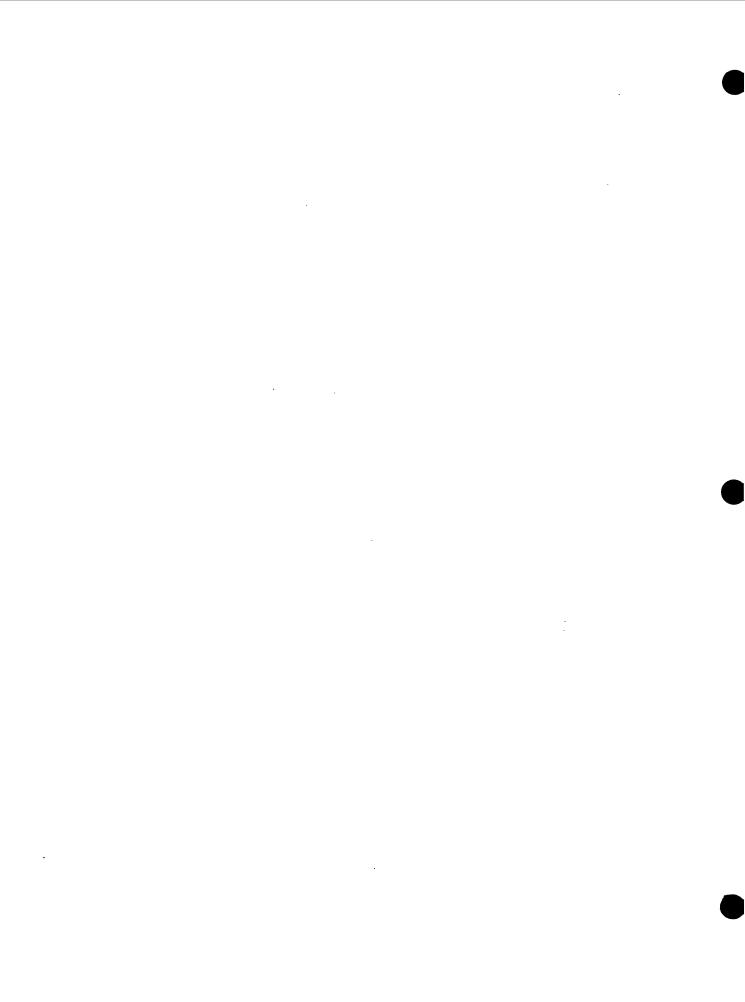
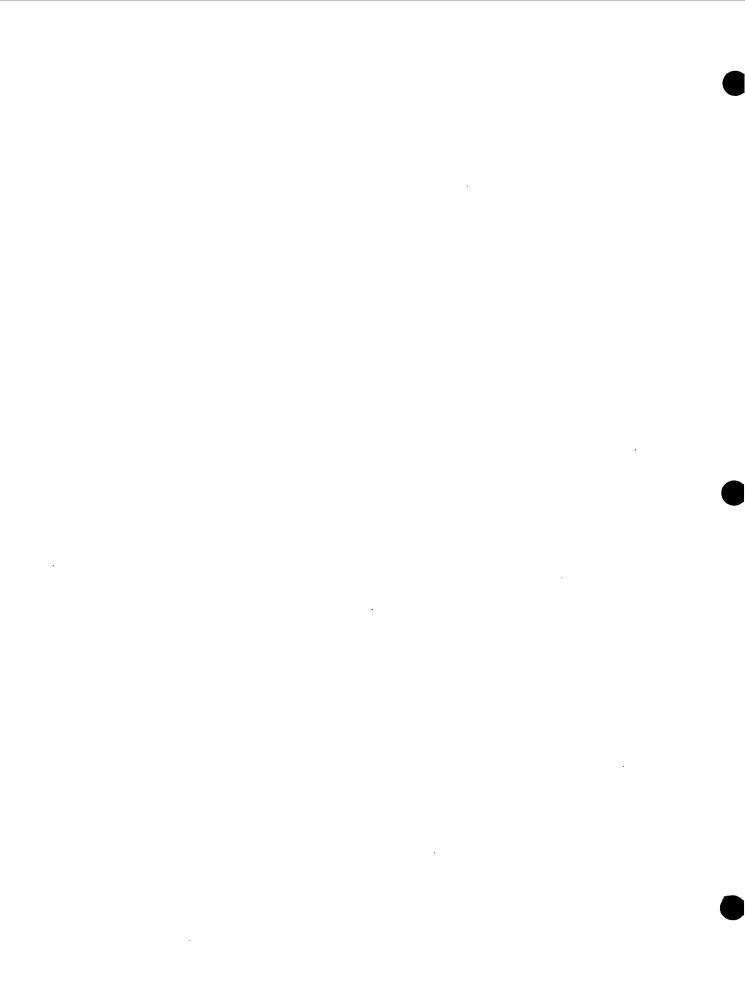


Table 3. -- Data on samples collected from the Whalen mine and vicinity--Continued.

ڙ	مامسح		Crushed rock	ock	Heavy-mi	Heavy-mineral fraction $\frac{3}{2}$
File no.	Field no.	Location and description	(percent)	(percent)	(percent)	ratio
	Samples c	Samples collected from some of the prospect holes along the contact between the monzonite	ong the contact	between the m	onzonite	
		and limestone in the vicinity of the Whalen mine	he Whalen mine.			
3629	49AWe 153	Hole no. 21; limestone	0.004	į į	0.010	170:1
3630	154	Hole no. 24; monzonite	.003	į į	.010	90:1
3631	155	Hole no. 25; monzonite	.003	1	40.	40:1
3632	156	Hole no. 32; limestone	000.	l i	.00	50:1
3633	157	Hole no. 51; limestone	.002	!	400.	40:1
3634	158	Hole no. 52; limestone	900.	1	.018	20:1
3635	159	Hole no. 54; monzonite	.002	1	.004	20:1
3636	160	Hole no. 56; monzonite	.003	i	800.	50:1
3637	191	Hole no. 60; monzonite	.00.	ľ	.003	25:1
3638	162	Hole no. 61; limestone	.005	1 6	.019	300:1
3639	163	Hole no. 65; monzonite	.001	i	.003	30:1
3640	78	Hole no. 68; limestone	.004	ı	900°	60:1
3641	164	Hole no. 74; monzonite	.005	l 1	200	25:1

1/ eU – equivalent uranium $\overline{2}/$ U – uranium $\overline{3}/$ that greater than 2.8 specific gravity



minerals in these samples are allanite, hematite, zircon, and sphene.

Ruby Creek area

Samples from Ruby Creek are not plotted on figure 1, but their locations are described in table 4. The most radioactive sample obtained in the Ruby Creek drainage (no. 3570, table 4) contains 0.078 percent equivalent uranium. The sample is a sluice-box concentrate from the Strand placer mine on Ruby Creek at the foot of the headwaters gradient of Crystal Gulch. Most of the lode deposits on the Nixon Fork Mining Co. property are located at the head of this gulch. The percentages of the minerals in the fraction greater than 2.8 specific gravity of this concentrate are given in table 5. Most of the radioactivity in this sample is probably due to the thorianite. The unknown secondary minerals were analysed spectrographically. The yellow mineral contains bismuth, lead, copper, iron, vanadium, and silicon as major constituents, and calcium, aluminum, arsenic and antimony as minor constituents. The green mineral contains copper, bismuth, silicon, calcium, iron, and lead as major constituents, and aluminum, vanadium and phosphorous as minor constituents. The source of neither the thorianite nor the secondary uranium-bearing minerals was found, though search was extended to all the slopes of Ruby Creek along the contact and in the monzonite, where these slopes were not thickly covered by moss. It is possible that these minerals are derived from a restricted zone at or close to the contact, much as the parisite-bearing zone at the contact in the Whalen Mine "glory hole". The radioactivity in all the concentrates and rock samples from the head of Ruby Creek is probably due mainly to the minerals zircon and sphene as thorianite was not found in them.

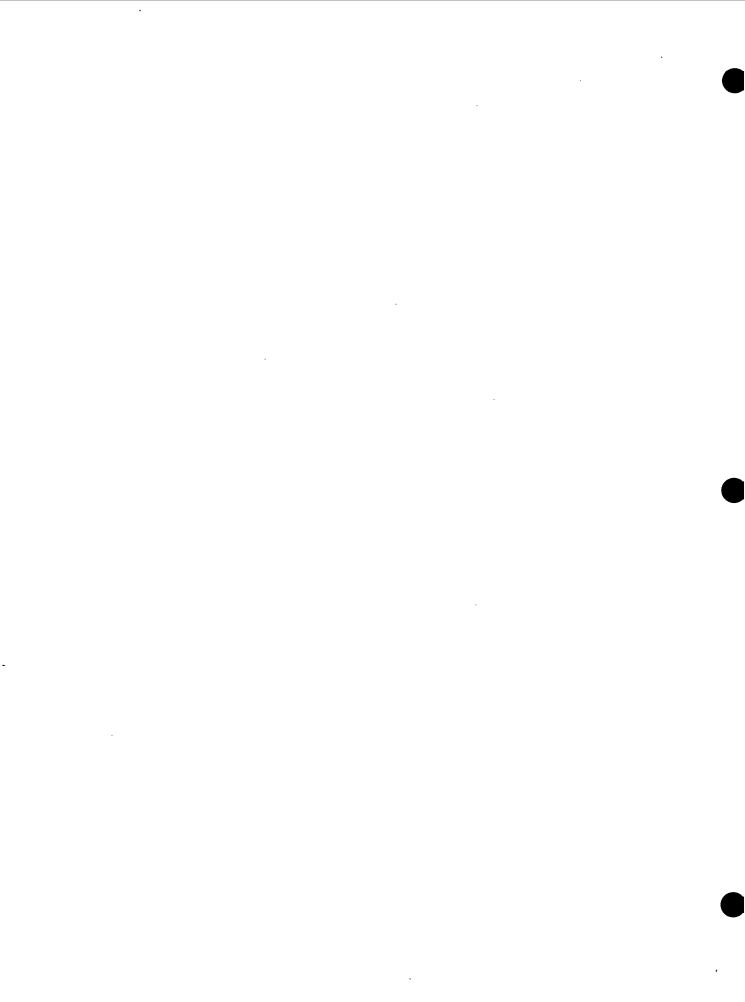


Table 4.--Data on bedrock samples and concentrates collected in the Ruby Creek area in 1949.

Sam File no.	Samples 5. Field no.	no.	Location and description	Crushed rock eU 1/ U (percent) (per	rock U 2/ (percent)	Heavy-min eU (percent)	Heavy-mineral fraction 3/ eU Concentration (percent) ratio
3558	49ASv 91	16	Head of Ruby Creek; placer concentrate	ł	ł	0.007	300; 1
3567	7	9	Ruby Creek; placer concentrate at foot of	1	ŀ	900.	130:1
3568)[10	Same as sample 3567	!	!	800°	290:1
3569	=	102	Crystal Gulch; concentrate from head of	! !	ł	.02	650:1
3570	Ŧ	103	placer workings Ruby Creek; sluice-box concentrate from Strand placer workings	1	1	.078	very high
3593	49AWe 89	89	Along trail on left limit of Crystal Gulch; monzonite	0.004	ł	.005	15:1
3594	•	16	Along road from mill to Garnet Shaft; monzonite	.003	;	900.	9:1
3596	J ,	94	Bench on right limit of Ruby Creek above	!,	!	.011	1:069
3597	•	95	Same as sample 3596; undisintegrated rock	• 003	l l	500°	10:1
3598	•	26	At mouth of Crystal Gulch in Strand placer	!	1	400	650; 1
3599	<u>.</u>	8	mine; snarrered monzonire On north side of Strand placer mine; panned concentrate from disintegrated granitic	i	i i	.013	2,270;1
3600		68	dike in monzonite Same as sample 3599; quartz veins paralleling granitic dike	.002	i i	010°	220:1

1/ eU - equivalent uranium $\overline{2}/$ U - uranium (determined chemically) $\overline{3}/$ that greater than 2.8 specific gravity

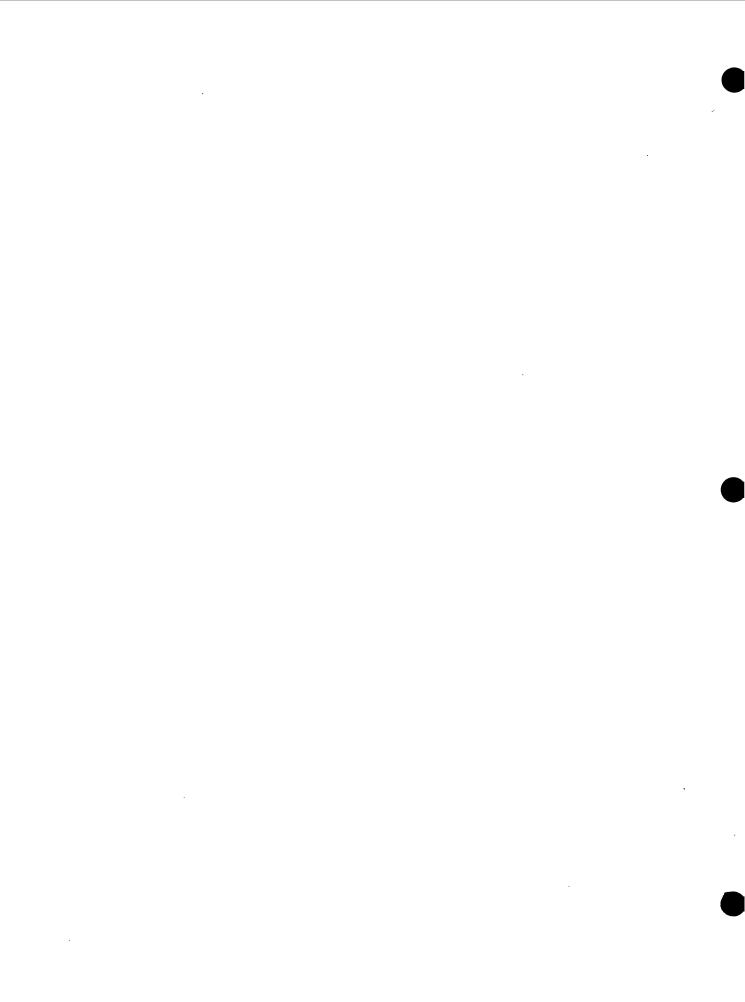


Table 4. -- Data on bedrock samples and concentrates collected in the Ruby Creek area in 1949--Continued.

San File no	Samples	noiteinado bas seitano l	Crushed rock eU 1/ U 2/	Crushed rock J $\frac{1}{1}$ U $\frac{2}{1}$	Heavy-min eU	Heavy-mineral fraction 3/ eU Concentration
	200	בסכים מפיסכו היים מפיסכו	(percein)	(percent)	(money)	2
3601	49AWe 101	On south side of Strand placer mine; panned concentrate of disintegrated granitic dike	1	!	0.032	780:1
3602	102	Same as sample 3601; undisintegrated rock	0.003	i i	.016	80:1
3603	102	Strand placer mine; inclusions in monzonite	.002	ļ	.003	5.1
3604	105	Middle Crystal Gulch; bedrock from contact	.002	1	200.	70:1
		zone				
3607	111	Same as sample 3594; panned concentrate	;	!	.015	1,800:1
3608	112	Same as sample 3594; panned concentrate	ł	!	.033	2,270:1
3609	113	Same as sample 3594; undisintegrated aranitic dike in monzonite	800°	0.004	. 021	100:1

1/ eU – equivalent uranium $\overline{2}/$ U – uranium (determined chemically) $\overline{3}/$ that greater than 2.8 specific gravity

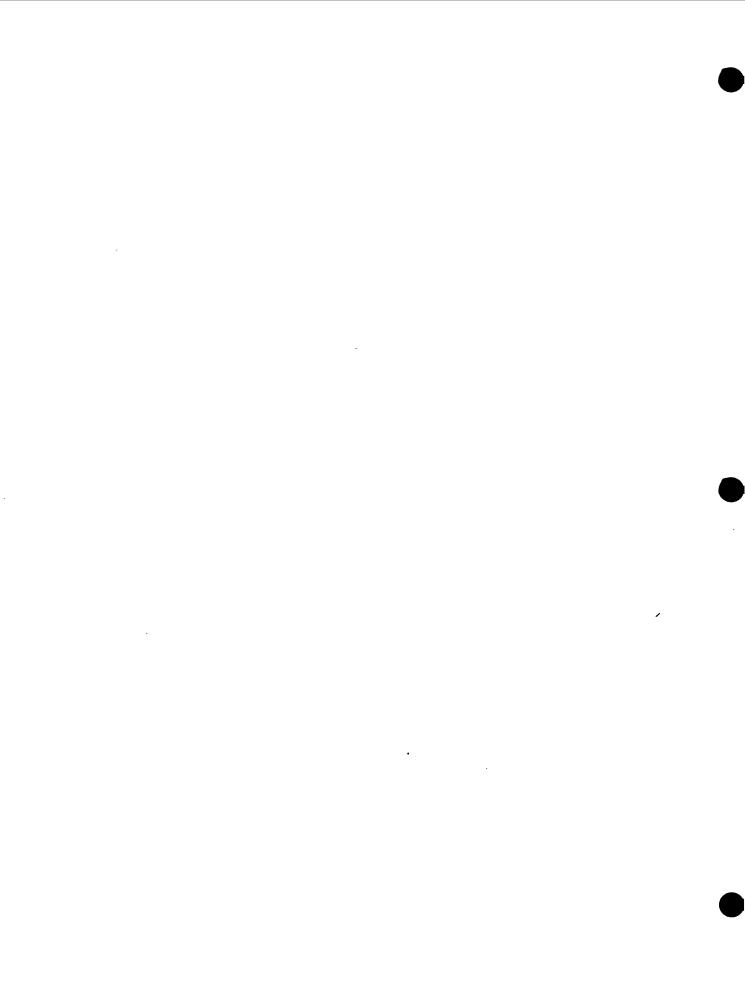
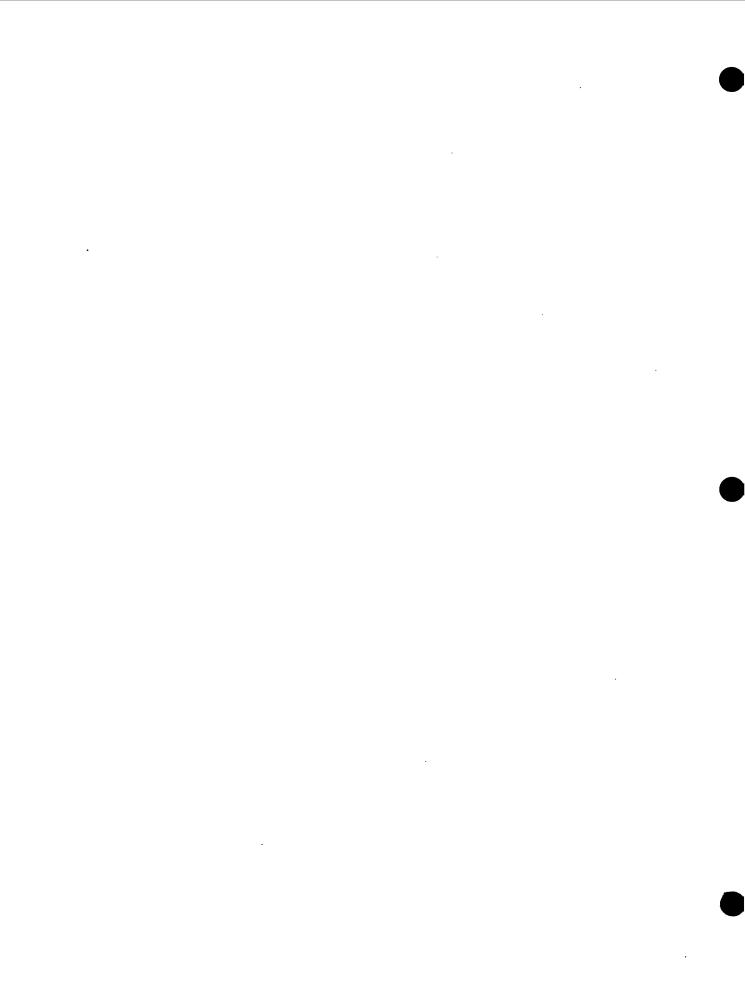


Table 5.--Mineralogy and radioactivity of three placer concentrates from the Nixon Fork mining district.

Minerals	Sample no.	Sample no. 3642	Sample no.
Allanite		3* 1/	1*
Azurite	tr		Mys. con
Cassiterite	3	· 	ando tam
Common rock-forming minerals	4	2	
Fluorite	tr	1	tr
Garnet		5	4
Gold	a 2/		
Hematite	a*	tr*	
Ilmenite	<i>7</i> 0	85	80
Malachit e	tr*	***	
Magnetite	13	tr	8
Monazite			tr
Powellite			tr
Pyrite			tr
Scheelite	5	3	4
Sphene	a*	tr*	
Thorianite	a*	1*	ן*
Unknown secondary green mineral	tr*	144 MP	
Unknown secondary yellow mineral	tr*		
Uraninite			1*
Zircon	a*	tr	tr
Equivalent uranium content (percent)	0.078	0.26	0.18
Uranium content (percent)	n.d.	n.d.	.06

^{1/} Estimated volume percent; the asterisk indicates that the mineral is uraniumbearing as determined by a sodium fluoride flux test.

^{2/}a indicates that these five minerals total 5 percent of the sample.



Nixon Fork mine

Almost all the ore that was processed from all the shafts and prospect pits in the vicinity of the Nixon Fork mine was processed at the stamp mill located at the head of Ruby Creek (fig. 1). The tailings from the milling operation, crushed to fine silt size, were dammed up at the rear of the mill in the expectation that with further refinement of the milling processes additional gold could be recovered from these tailings. Radiometric tests of these tailings in the field indicated no appreciable radioactivity. However, in order to determine whether any radioactive minerals had been carried over into the tailings during milling operations, the mill tailings pile was sampled both across the surface or top (with holes 3 to 4 feet deep) and across the base. As the equivalent uranium content of the heavy-mineral fractions (those greater than 2.8 specific gravity) of these samples ranges only from 0.002 to 0.008 percent (table 6), it is obvious that very little radioactive material occurs in the tailings.

Samples of ore were collected and tested from various ore and concentrate bins in and near the mill. The maximum equivalent uranium content of any of these samples is 0.019 percent. The radioactivity is apparently associated with iron oxides in the ore. Table 6 lists the data on all the samples collected in and near the mill.

Crystal shaft .--The Crystal shaft (fig. 1) of the Nixon Fork mine is located in a highly metamorphosed zone of rock that probably includes both monzonite and limestone. About 50 feet northeast of the shaft a massive garnet rock underlies garnet-bearing, marmorized limestone and contains as much as 0.025 percent equivalent uranium. Study of samples from this locality (table 7) shows that the radio-activity is associated with garnet rock that is somewhat impure and weathered. The fresh, unweathered garnet is nonradioactive. The impurity in the garnet occurs in

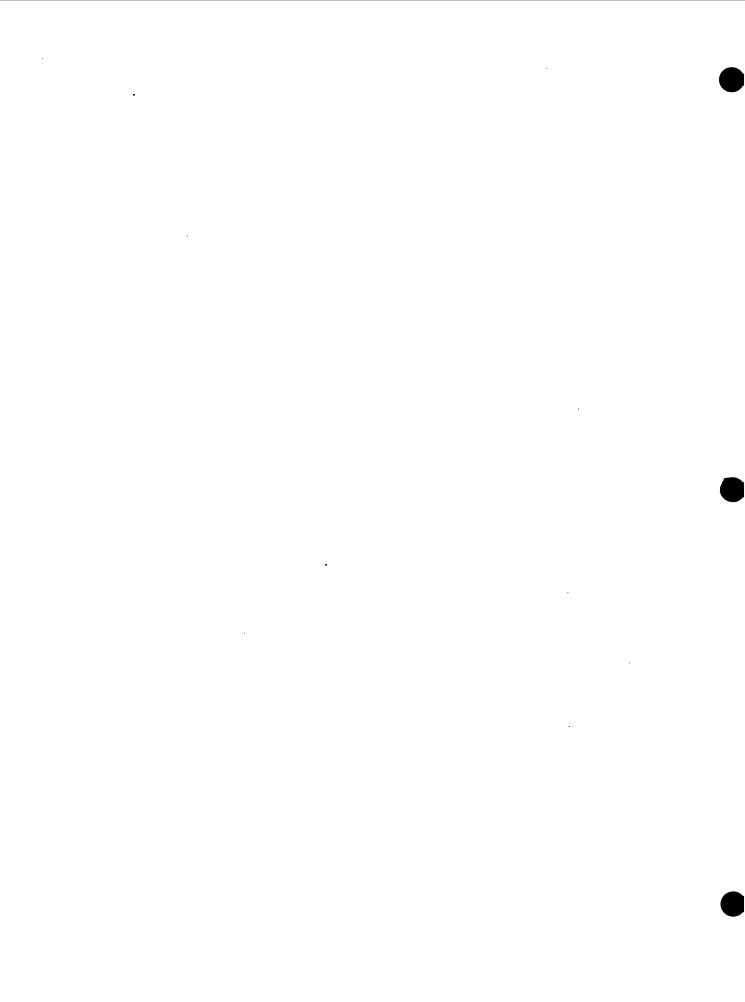


Table 6.--Data on ore, mill, and tailings samples from the Nixon Fork mine, 1949.

Sar	Samples	notation description	Crushed rock	Heavy-mir	Heavy-mineral fraction 2/
	1	_ I		ao (barcani)	
3542	49ASv 75	Nixon Fork mill; mill tailings	1	0,002	1,950:1
3543	76	Small stream along side of Nixon Fork	8	.00.	370,1
		mine; mill tailings			
3544	11	Nixon Fork mine mill; mill tailings	ì	.003	590:1
3545	78	Do:	ŧ	800.	3,400:1
3546	. 79	D°.	1	°,000	620:1
3547	80	<u>د</u>	1	40°	120:1
3548	81	2	1	.002	1,360:1
3549	82	D°.	1	.003	1,360:1
3550	83	<u>څ</u>	i	.002	560:1
3551	\$	ß.	1	.003	750:1
3552	85	Nixon Fork mine mill; crushed ore,	1	.003	Ç.
		partly concentrated			
3553	98	°2	Î	°003	Ç
3554	87	2	1	900°	C
3555	88	ρ,		400°	Ç~
3556	89	%	1	400.	(~
3557	8	Nixon Fork mine mill; mill tailings	ŀ	.002	1,360:1
3559	26		1	.002	500:1
3560	93	۵	ļ	° 000	2,700:1
3561	46	8.	1	400.	270:1
3562	95	2	ŧ	.002	450:1
3563	%	മ്	*	.002	210:1
3564	62	°	1	° 005	500:1
3565	86	8	;	.003	900:1
3566	66	. Dō.	E E	.002	380:1
1/ eU = 0	- equivalent uranium t areater than 2,8 spe	eU - equivalent uranium that greater than 2.8 specific gravity			
! }!		/			

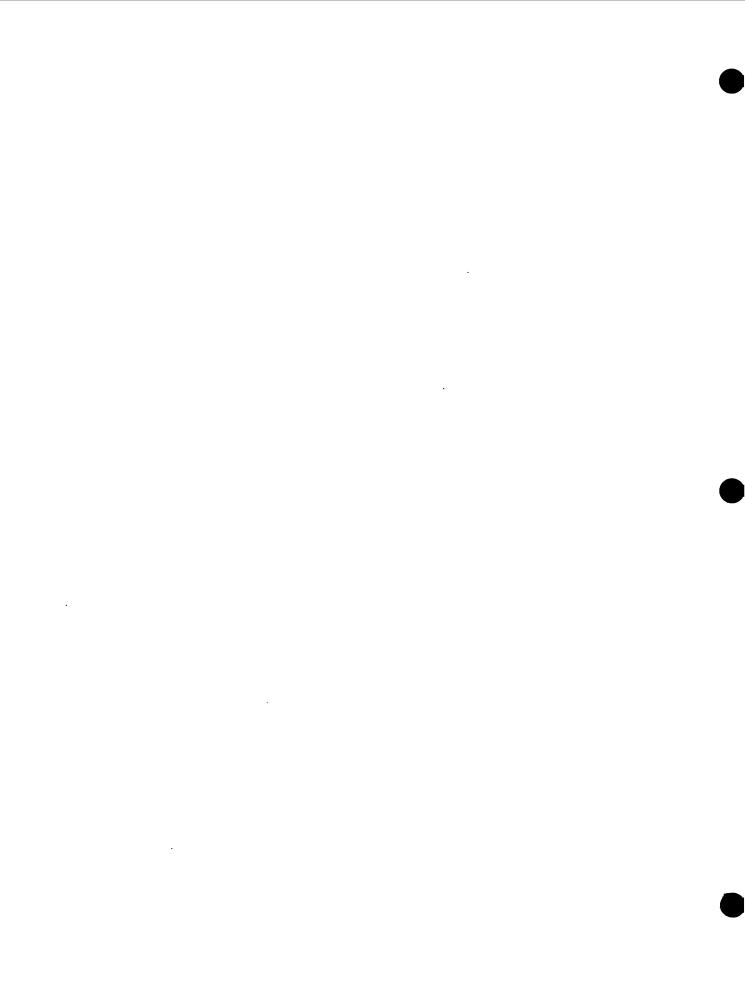


Table 6. -- Data on ore, mill, and tailings samples from the Nixon Fork mine, 1949--Continued.

S	Samples Filena Field no	location and description	Crushed rock	() 	Heavy-mineral fraction $\frac{2}{2}$
			-/		
3588	49AWe 81	Nixon Fork mine; gold ore	0000	0.001	
3589	82	Nixon Fork mine, oxidized ore	200°	200°	2:1
3590	83	۵°	600°	.012	3.1
3591	85	ϰ.	900°	.00°	3:1
3592	98	٥٠	°10°	010°	2,1
3595	93	Nixon Fork mine; partly milled ore	°,00	900°	C
		from Garnet shaft			
3605	107	Nixon Fork mine; malachite ore from	°,000	!	1
		Crystal shaft			
3606	109	Nixon Fork mine; malachite ore from	900°	ŧ	!
		Garnet shaft			

1/ eU - equivalent uranium $\overline{2}/$ that greater than 2.8 specific gravity

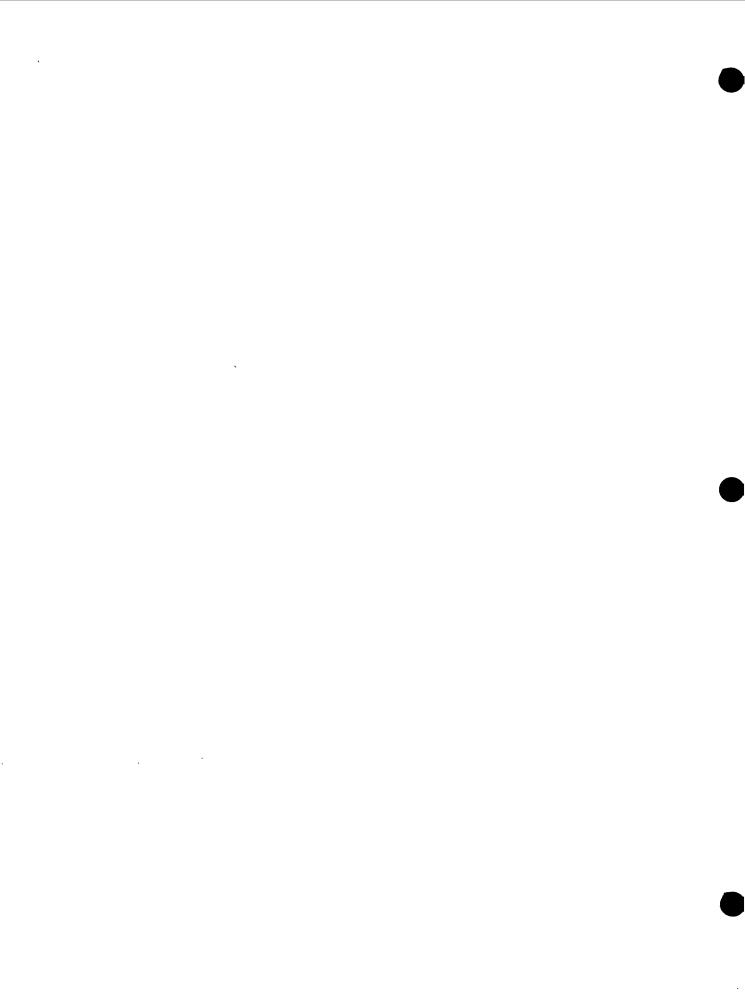
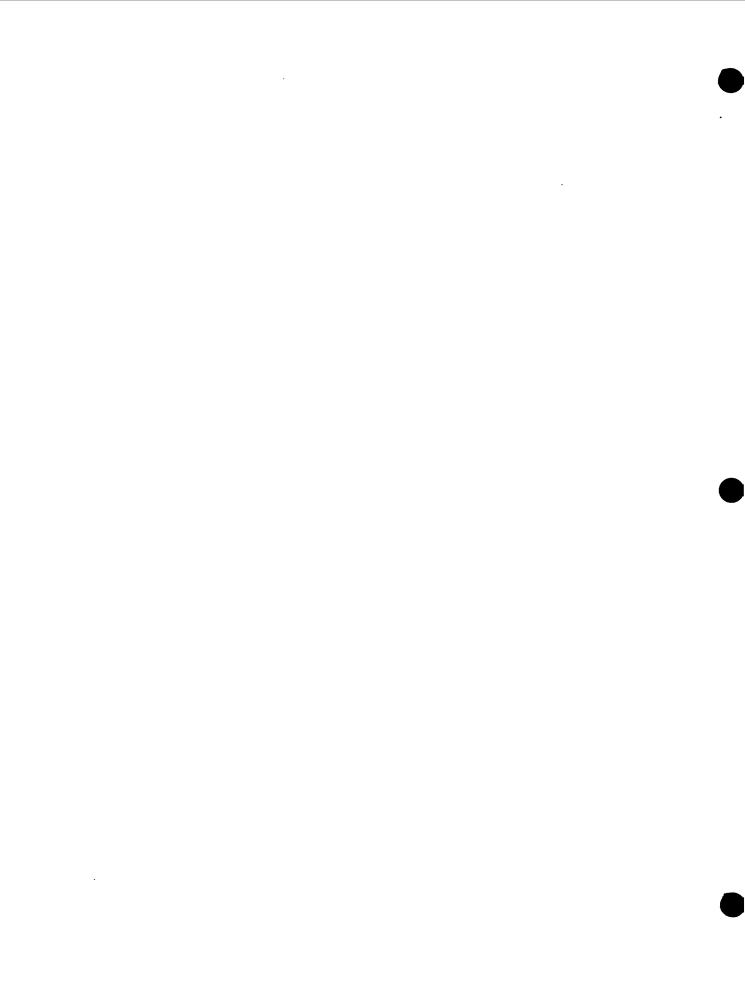


Table 7.--Data on samples of garnet rock from the vicinity of the Crystal shaft, Nixon Fork mine.

Sampl File no.	Samples no. Field no.	0	Description	Crushed rock $\frac{2}{2}$ Heavy-mineral fraction $\frac{3}{2}$ eU (percent) Concentration	(percent) e	Heavy-mine U (percent)	ral fraction $\frac{3}{4}$ Concentration ratio
3610	49AWe 115	S	Surface wash on contact between limestone and monzonite 50 feet northeast of Crystal shaft; panned	l	l	0.014	270,1
3611	=	116 Random f	Random fragments of garnet rock showing high randinactivity	0.018	0.008	i i	ł
3612	711		Clean, unweathered garnet rock from shaft	000°	1	1	!
3613	118		Do	000°	!	!!	I t
3614	119		Selected specimen of garnet rock showing strongest radioactivity	,025	° 008		1
3615	120		Garnet rock showing strong radio-	,017	900°	.026	10:1
3617	122		Monzonite at contact with garnet rock	.003	:	900°	25:1
3618	123	S	Same as sample 3617; concentrate obtained by panaing crushed rock	I	1	.012	60:1

^{1/} eU = equivalent uranium $\overline{2}/$ U = uranium (determined chemically) $\overline{3}/$ that greater than 2.8 specific gravity



thin beds or irregular masses and is well coated with hydrous iron oxides. The composition of the garnet rock, exclusive of the hydrous iron oxides, is 65 percent garnet, 20 percent idocrase, 12 percent common rock-forming minerals, 3 percent sphene, and traces of zircon and magnetite. The radioactive minerals are idocrase and sphene. In a field inspection the radioactive material in the garnet appears to be mainly an iron-oxide coating and filling in fractures and fissures in the rock.

No significant radioactivity was detected at any of the numerous other prospect pits and shafts on the property of the Nixon Fork mine.

Other localities examined

Mystery, Puzzle, and Submarine Creeks

Three concentrates were collected from gravels in Mystery and Puzzle Creeks to supplement the samples from these creeks previously available in the Alaskan Geology Branch concentrate file (table 1). The radioactivity of the three samples is given below:

Sampl	es		Heavy-mi	neral fraction
File no. F	ield no.	Location	eU (percent)	Concentration ratio
3571 494	Sv 104	Mystery Creek	0.006	125: 1
3572	105	Mystery Creek	018ء	3,025:1
3573	106	Puzzle Creek	.003	130:1

Radiometric traverses were made around the heads of these two creeks as well as Sub-marine Creek, particularly along the ridge of which Strand and Jumbo Peaks are a part (fig. 1). No radioactivity anomalies were found.

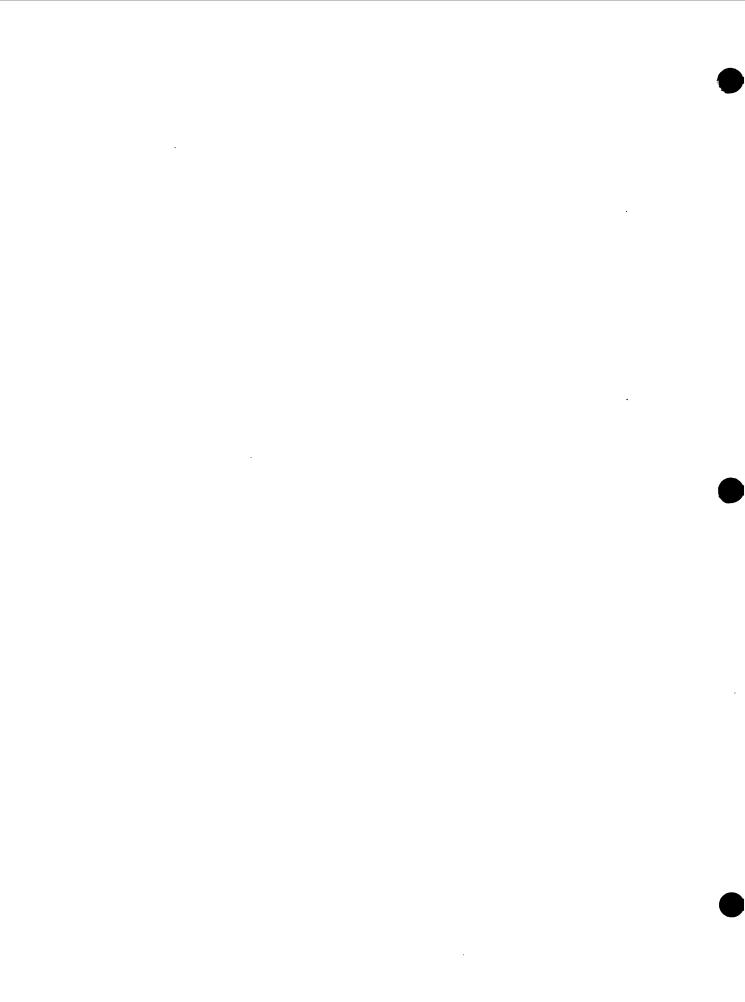
Eagle Creek

Eagle Creek, a tributary of Crooked Creek, is located about 5 to 7 miles south of the Nixon Fork mines (fig. 1). B. A. Stone of Medfra operates a small gold-



lode mine on the headwater slopes of the creek near the contact between the limestone country rock and a small monzonite mass. The heavy-mineral fraction (that greater than 2.8 specific gravity) of a sluice-box concentrate (sample no. 3642) from a placer operation on Eagle Creek owned by Stone contains 0.26 percent equivalent uranium. The mineral composition of the Eagle Creek sluice-box concentrate is given in table 5. The radioactivity appears to be due chiefly to the uraniferous thorianite, although the allanite, hematite, and sphene are also radioactive. Radiometric traverses along the headwater slopes of Eagle and Skookum Creeks (fig. 1) failed to find the bedrock source of the radioactive minerals. A sample (no. 3644) of the monzonite on Eagle Creek contains only 0.003 percent equivalent uranium and a sample (no. 3643) of garnet rock from the lode mine contains less than 0.001 percent equivalent uranium. Again, however, the negative radiometric data obtained in traversing is not conclusive because of the thick vegetation cover over most of the area.

In 1950 a placer concentrate containing 0.18 percent equivalent uranium and 0.06 percent uranium was received from a prospector, who indicated only that it came from western Alaska; information obtained later suggests that it is probably from a placer mine in the Nixon Fork district. The mineralogy of this sample (no. 3850) is compared with two other placer concentrates from the Nixon Fork district in table 5. The marked similarity of this concentrate to that from Eagle Creek (no. 3642) suggests the probability that it also is from Eagle Creek rather than elsewhere in the district. Of note is the occurrence of uraninite as well as the uraniferous thorianite.



SUMMARY AND CONCLUSIONS

A summary of significant radioactivity data obtained in the Nixon Fork mining district in 1949 is given in table 8. The only radioactive mineral of major importance is uraniferous thorianite, although such minerals as allanite, parisite, idocrase, sphene, zircon, malachite, and two unidentified secondary polymetal minerals are also radioactive. Uraninite has been identified in a concentrate that may have come from a placer mine in the district. The bedrock source of the uraniferous thorianite has not been located, but is believed to occur, at least in part, in a restricted zone or zones at or near the contact between limestone and monzonite similar to the gold-copper ores of the district and the radioactive parisite zone at the Whelan mine and the radioactive garnet rock zone at the Crystal shaft of the Nixon Fork mine.

Search for bedrock sources of the radioactive minerals in the district by radiometric surveying is hampered considerably by the shielding effect of the heavy moss cover so prevalent through much of interior Alaska.

It is suggested that geochemical prospecting techniques, such as the analysis of samples of disintegrated material taken from auger holes through the shielding moss cover may prove more successful in locating the bedrock source of the uranium—and thorium—oxide minerals than surface radiometric traversing. Such sampling might well be supplemented by the radiometric logging of the auger holes with a survey meter such as a portable scaler. Much study on the application of geochemical prospecting techniques in Arctic and sub–Arctic regions is needed, however, before a routine can be developed.

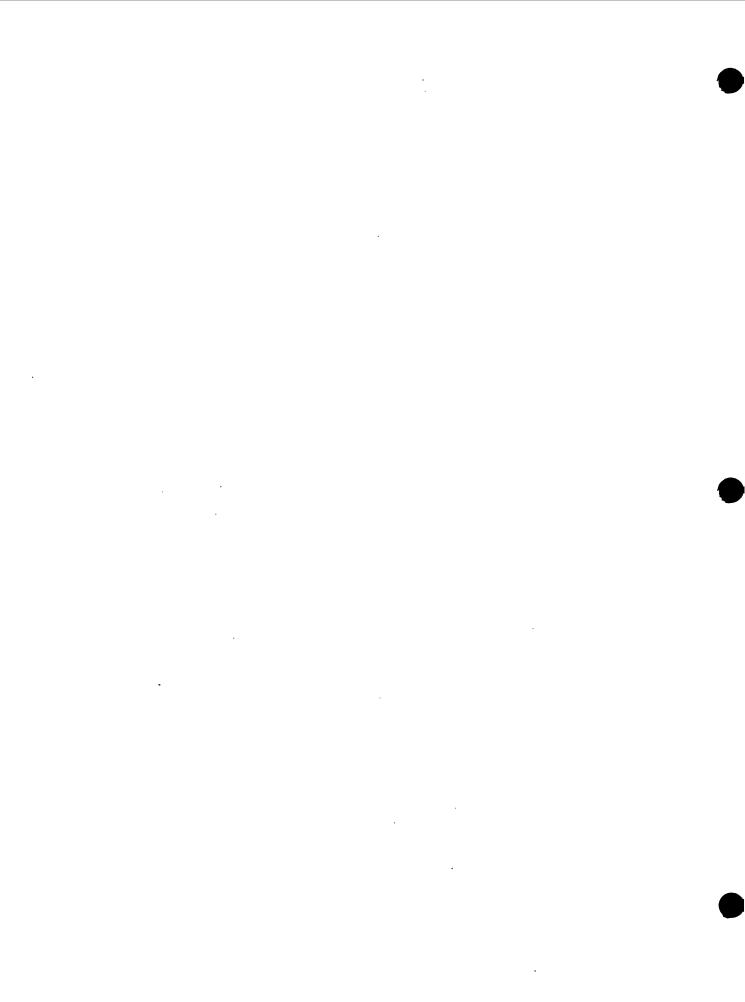


Table 8.--Summary of significant radioactivity data obtained in the Nixon Fork mining district, 1949.

Location and type of material tested	Radioactive minerals	Maximum radioactivity Percent eU Percent (ioactivity Percent U
	Placers		
Hidden Creek and tributaries Ruby Creek area	Uraniferous thorianite	0.012	1
Śluice-box concentrate from Strand placer mine	Uraniferous thorianite, hematite, zircon, sphene, malachite, and two unidentified secondary minerals	.078	1
Mystery Creek and tributaries Eagle Creek	Not determined	.018	1
Sluice-box concentrate from Stone placer mine	Uraniferous thorianite, allanite, and sphene	.26	!
Placer concentrate, location unknown but possibly from Eagle Creek (submitted by prospector in 1950)	Uraninite, uraniferous thorianite, and allanite	81.	90.0
	Bedrock		
Whalen mine Metamorphosed limestone on waste dump Altered limestone in "glory hole" Limestone and monzonite in prospect holes	Allanite Parisite Allanite, hematite, zircon, and sphene	.05 .00.	.004

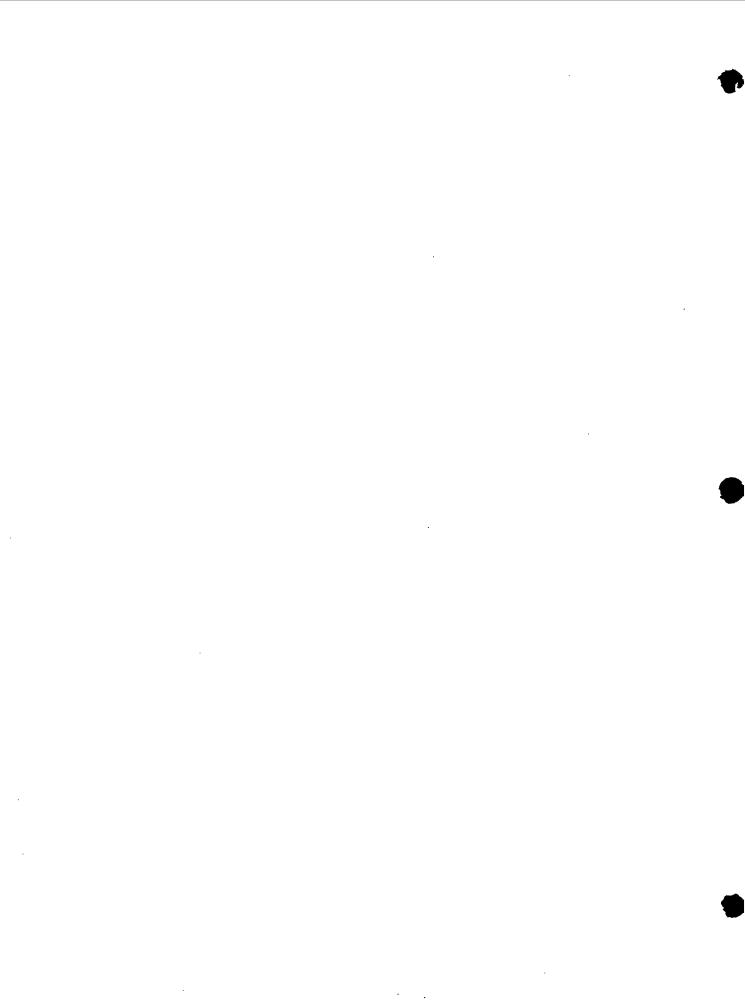
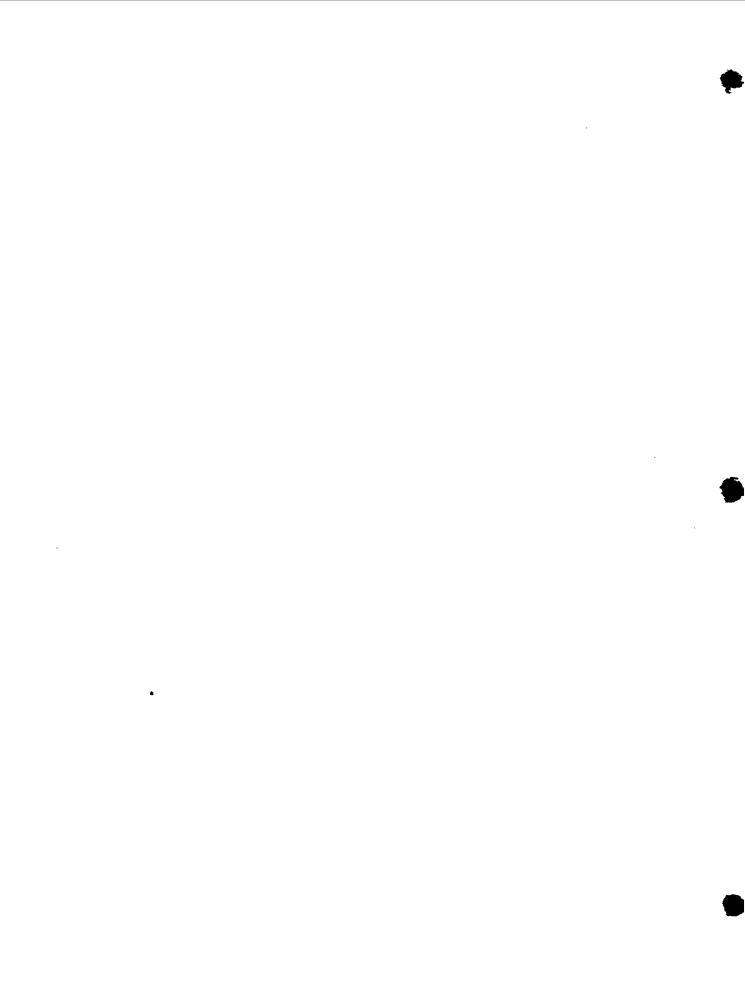


Table 8.--Summary of significant radioactivity data obtained in the Nixon Fork mining district, 1949--Continued.

Location and type of material tested	Radioactive minerals	Maximum radioactivity Percent eU Percent U	Maximum radioactivity ercent eU Percent U
	Bedrock		
Ruby Creek area			
Monzonite	Zircon and sphene	0.004	!
Granitic dike in monzonite	Zircon and sphene	800.	i i
Nixon Fork mine			
Mill tailings concentrates	Not determined	900.	i
Ore samples from ore bins in mill	Iron oxides	.019	!
Altered garnet rock from Crystal shaft	Idocrase, sphene, and iron oxides	.025	0.008
Fresh garnet rock from Crystal shaft	. !	000.	i
Eagle Creek			
Monzonite	Not determined	.003	!
Garnet rock	Not determined	.001	!



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